different occupancy state of the seat and being formed from data from said transducers while the seat is in that occupancy state,

said algorithm producing the output indicative of the current occupancy state of the seat upon inputting a data set representing the current occupancy state of the seat and being formed from data from said transducers.

A10 cancel. 70. A system for determining the occupancy state of a seat in a vehicle in combination with the vehicle, the system comprising:

a plurality of transducers arranged in the vehicle, each of said transducers providing data relating to the occupancy state of the seat, at least one of said transducers being selected from a group consisting of seat belt buckle sensors, seatbelt payout sensors and inductive sensors; and

processor means coupled to said transducers for receiving the data from said transducers and processing the data to obtain an output indicative of the current occupancy state of the seat, said processor means comprising an algorithm created from a plurality of data sets, each of said data sets representing a different occupancy state of the seat and being formed from data from said transducers while the seat is in that occupancy state,

said algorithm producing the output indicative of the current occupancy state of the seat upon inputting a data set representing the current occupancy state of the seat and being formed from data from said transducers.--

REMARKS

Entry of this amendment and reconsideration of the present application, as amended, are respectfully requested.

Claims 1, 3, 5-23, 25-65 and new claims 70-77 are presently active in this application, claims 2, 4, 24 and 66-69 having been cancelled. In spite of the cancellation of claims 2, 4, 24 and 66-69, applicants do not disclaim the subject matter of these claims as originally filed and in fact, reserve the right to prosecute the subject matter of these claims as originally filed, e.g., in a continuation application.

Claims 1, 3, 5, 25, 31, 32, 34, 49, 51-53 and 61 are amended herein. In spite of the amendments to these claims, applicants reserve the right to traverse the Examiner's rejections of the claims as previously set forth and the Examiner's positions set forth in the Office Action, e.g., by filing a continuation application with such claims.

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Rejection under 35 U.S.C. §112

Claims 1 and 5 were rejected under 35 U.S.C. §112, second paragraph, in view of informalities in claims 1 and 5.

The preamble of independent claim 1 has been amended to clarify that the invention is a system for determining the occupancy state of a seat in a vehicle in combination with the vehicle. This is necessary because the invention also entails a particular arrangement or placement of the transducers of the system in the vehicle (see, e.g., claim 14). The preambles of independent claims 31 and 49 have been similarly amended.

Claim 5 has been amended to clarify that the reclining angle sensor detects a title angle of the back portion of the seat. Claims 34 and 61 have been similarly amended.

In view of the changes to claims 1 and 5, it is respectfully submitted that the Examiner's rejections of these claims under 35 U.S.C. §112, second paragraph, has been overcome and should be removed.

Rejection under 35 U.S.C. §102(b)

Claims 1-4, 24, 28, 31-33, 49 and 66-69 were rejected under 35 U.S.C. §102(b) as being anticipated by Corrado et al. (U.S. Pat. No. 5,482,314). (Since claims 2, 4, 24, 66-69 have been cancelled, the rejection of these claims has been rendered moot.)

The Examiner's rejection is respectfully traversed in view of amended independent claims 1, 31 and 49.

Claims 1, 3 and 28

Claim 1 has been amended to specify that the processor means comprise a trained pattern recognition algorithm created from a plurality of data sets and which produces the output indicative of the current occupancy state of the seat upon inputting a data set representing the current occupancy state of the seat.

Corrado et al. does not teach or suggest use of such a trained pattern recognition algorithm for occupancy state determination. Specifically, Corrado et al. is based on the use of a process referred to as "sensor fusion" as discussed extensively in the specification at page 7. In a preferred embodiment of the sensor fusion process used in Corrado et al., signals from infrared and ultrasonic sensors are input into a microprocessor by means of a sensor fusion algorithm to produce an output signal (col. 7, lines 15-18). During operation, the fusion processing compares the signals to a matrix of known condition confidence values to produce a set of confidence weighted values (col. 7, lines 28-32).

In light of the foregoing, it is respectfully submitted that the sensor fusion process is not "trained" in that it is not taught to recognize various patterns constituted within signals by subjecting the process to a

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variety of examples. A definition of a trained or trainable pattern recognition algorithm is provided in the specification at page 8, line 19 to page 9, line 2.

To further support the critical difference between a trained pattern recognition algorithm as now claimed in claim 1 and the sensor fusion process of Corrado et al. a Declaration of Inventor David S. Breed Under 37 C.F.R. §1.132 is attached. As set forth therein, a sensor fusion algorithm is fundamentally different than a trained pattern recognition algorithm and one skilled in the art of occupancy determination systems would not have been motivated to use a trained pattern recognition algorithm instead of the sensor fusion process of Corrado et al.

Thus, Corrado et al. does not teach or suggest the embodiment of the invention now set forth in claim 1, as well as the embodiments of claims 3 and 28 which depend from claim 1.

Claims 31-33

Claim 31 has been amended to specify that each transducer generates "only a single stream of data relating to the occupancy state of the seat" and that the processor means receive "only the single stream of data from each of said transducers such that the stream of data from each of said transducers is passed to said processor means from said transducer without combining with another stream of data".

As noted above, Corrado et al. is based on the use of a process referred to as "sensor fusion". The inventors have recognized that there are potential problems with such a sensor fusion process and discovered that it is more efficient to use a trained pattern recognition algorithm, such as a neural network or a fuzzy logic algorithm, which receive separate streams of data from sensors without combining the data prior to processing. This process is shown in Annex A which is a flow chart easily compared to the flow chart in Fig. 14 of Corrado et al.

The invention set forth in claim 31 does not encompass sensor fusion and in fact, expressly differentiates from a sensor fusion process in view of the explicit recitation of only single streams of data being generated by the transducers and the processor receiving only the single streams of data from the transducers without that data combining with data from other transducers. This differentiation is recited in the specification at page 7, lines 13-27 and thus supports the amendment to claim 31.

Since Corrado et al. describes the use of sensor fusion which appears to be an essential feature of the Corrado et al. invention, it does not contemplate any other type of pattern recognition which does not involve sensor fusion, such as pattern recognition techniques in which data from each sensor is supplied to a processor and processed thereby without combining with data from another sensor as now set forth in claim 31.

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As such, Corrado et al. does not teach or suggest the embodiment of the invention now set forth in claim 31, as well as the embodiments of claims 32 and 33 which depend from claim 31.

Claim 49

Claim 49 has been amended to specify a particular arrangement of the wave-receiving transducers, specifically, that one transducer is arranged over a front portion of the seat or in front of the seat and a second transducer is arranged over a rear portion of the seat or behind the seat. This feature is shown in Fig. 2 wherein transducer 110 is arranged over a rear of the front seat and transducer 111 is arranged in front of the front seat. The arrangement of the transducers in this manner provides that an axis connecting the transducers extends through the space in which the front-seated passengers, in this case, are situated to thereby enable the advantages of the invention to be obtained (reference being made to Figs. 5 and 6).

Corrado et al. does not teach or suggest the arrangement of two wave-receiving transducers relative to the seat as now set forth in claim 49. Rather, as shown in Corrado et al., both the infrared sensor and the ultrasound sensor are housed in a common sensor suite or sensor unit 16.

In view of the changes to independent claims 1, 31 and 49 and the arguments presented above, it is respectfully submitted that the Examiner's rejection of claims 1, 3, 28, 31-33 and 49 under 35 U.S.C. §102(b) as being anticipated by Corrado et al. has been overcome and should be removed.

Rejection under 35 U.S.C. §103(a)

Claims 5-23, 25, 29, 30, 34-48 and 50-65 were rejected under 35 U.S.C. §103(a) as being unpatentable over Corrado et al. in view of Breed et al. (U.S. Pat. No. 6,081,757).

Initially, it is respectfully submitted that Breed et al. '757 should not be available as prior art in view of the fact that it was filed November 14, 1997, whereas the present applications claims priority of U.S. patent application Ser. No. 08/798,029 filed February 6, 1997 and U.S. patent application Ser. No. 08/919,823 filed August 28, 1997. Also, the present application claims priority under 35 U.S.C. §1.119(e) of U.S. provisional patent application Ser. No. 60/011,351 filed February 8, 1996 (see the Preliminary Amendment filed April 5, 2000). Thus, to the extent that the subject matter of claims 5-23, 25, 29, 30, 34-38 and 50-65 is disclosed in any of these earlier filed application, Breed et al. '757 should not be available as prior art.

Furthermore, with respect to claims 5-23, 25, 29 and 30, the Examiner's rejection is respectfully traversed because use of a trained pattern recognition algorithm (e.g., a neural network) as disclosed in Breed et al. would frustrate the purposes of the Corrado et al. invention.

Corrado et al. requires the use of sensor fusion which combines data from multiple sensors prior to processing. By contrast, a neural network does not require such pre-processing of data and thus

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implementation of a neural network would thus eliminate the essence of the sensor fusion process and fundamentally alter the Corrado et al. invention. Such an alteration of the Corrado et al. invention to eliminate sensor fusion would thus not be an obvious modification to one of ordinary skill in the art.

With respect to claims 34-48 and 52, any modification of Corrado et al. to eliminate the sensor fusion process, i.e., the generation of multiple streams of data from each transducer and the combination of streams of data from multiple transducers, would deviate significantly from the express purpose and objective of the Corrado et al. invention and thus would not be obvious to one of ordinary skill in the art. Accordingly, it would not have been obvious to one of ordinary skill in the art to use a neural network as disclosed in Breed et al. instead of the sensor fusion process of Corrado et al., or otherwise provide that each transducer generate only a single stream of data which is received by a processor means without combining with another data stream.

With respect to claims 58 and 59, Breed et al. does not disclose horns or grills for adjusting the transducer field angles of wave-receiving transducers to reduce reflections off of fixed surfaces within the vehicle.

With respect to claims 60-65, it is respectfully submitted that it would not have been obvious to one skilled in the art to combine purported teachings of Breed et al. and Corrado et al. and arrive at the embodiments of the invention set forth in these claims. Breed et al. describes the use of a neural network whereas Corrado et al. describes the use of sensor fusion. These process are significantly different to the extent that one skilled in the art would not readily consider applying teachings of Breed et al. in combination with the system of Corrado et al.

In view of the changes to independent claims 1, 31 and 49 and the arguments presented above, it is respectfully submitted that the Examiner's rejection of claims 5-23, 25, 29, 30, 34-48 and 50-65 under 35 U.S.C. §103(a) as being unpatentable over Corrado et al. in view of Breed et al. has been overcome and should be removed.

New Claims

New claims 70-77 are presented. Claims 70 and 71 are directed to the feature of the transducers including a wave-receiving transducer and a non-wave-receiving transducer. Claim 72 is directed to the feature of the algorithm in the vehicle of claim 33 being a trained pattern recognition algorithm.

Claim 73 is a new independent claim including the feature of one of the transducers being arranged on a top of a dashboard or instrument panel of the vehicle and a second transducer being arranged at a different location in the vehicle such that an axis connecting the transducers passes through a volume above

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the seat. Claims 74 and 75 depend from claim 73. Corrado et al. does not teach or suggest the systems set forth in claims 73-75.

Claim 76 is another new independent claims which includes subject matter from claims 1 and 26 as originally set forth and claim 77 includes subject matter from claims 1 and 27 as originally set forth. Claims 26 and 27 were not rejected in view of prior art and therefore it is respectfully submitted that claims 76 and 77 should be allowable.

If the Examiner should determine that minor changes to the claims to obviate informalities are necessary to place the application in condition for allowance, the Examiner is respectfully requested to contact the undersigned to discuss the same.

An early and favorable action on the merits is earnestly solicited.

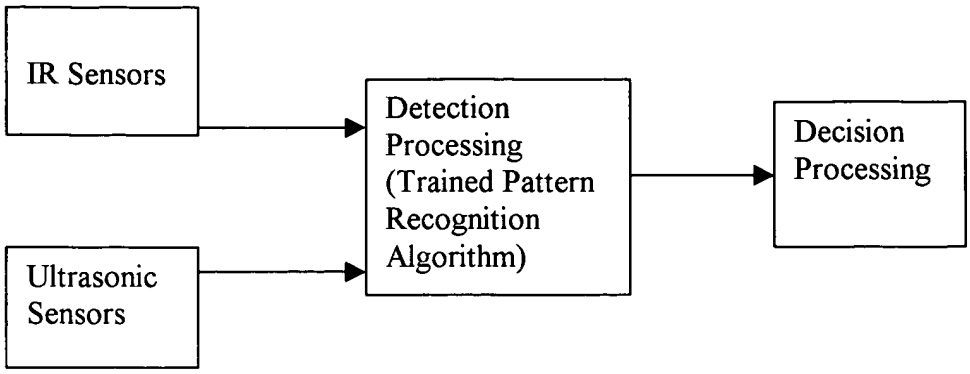
FOR THE APPLICANTS
Respectfully submitted,

Brian Roffe
Reg. No. 35,336

Brian Roffe, Esq.
366 Longacre Avenue
Woodmere, New York 11598-2417
Tel.: (516) 295-1394
Fax: (516) 295-0318

Enc.
Fee Transmittal Form
Annex A
Version With Markings To Show Changes Made
Declaration Of Inventor David S. Breed Under 37 C.F.R. §1.132

ANNEX A


IR Sensors
Ultrasonic Sensors
Detection Processing (Trained Pattern Recognition Algorithm)
Decision Processing

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

U.S. PATENT APPLICATION SER. NO. 09/474,147
ACCOMPANYING AMENDMENT OF JULY 19, 2001

In The Claims:

Claims 2, 4, 24 and 66-69 have been cancelled.

Claims 1, 3, 5, 25, 31, 32, 34, 49, 51-53 and 61 have been amended as follows.

1. (Amended) A ~~vehicle including a~~ system for determining the occupancy state of a seat in ~~the~~ a vehicle in combination with the vehicle, the system comprising:

a plurality of transducers arranged in the vehicle, each of said transducers providing data relating to the occupancy state of the seat; and

processor means coupled to said transducers for receiving the data from said transducers and processing the data to obtain an output indicative of the current occupancy state of the seat, said processor means comprising ~~an~~ a trained pattern recognition algorithm created from a plurality of data sets, each of said data sets representing a different occupancy state of the seat and being formed from data from said transducers while the seat is in that occupancy state,

said trained pattern recognition algorithm producing the output indicative of the current occupancy state of the seat upon inputting a data set representing the current occupancy state of the seat and being formed from data from said transducers.

3. (Amended) The vehicle of claim 1, wherein each of said transducers generates only a single stream of data relating to the occupancy state of the seat and said processor means are arranged to accept only ~~a separate~~ the single stream of data from each of said transducers such that the stream of data from each of said transducers is passed to said processor means without combining with another stream of data.

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5. (Amended) The vehicle of claim 1, wherein at least one of said transducers is a reclining angle detecting sensor for detecting a tilt angle of ~~the seat between~~ a back portion of the seat ~~and a seat portion of the seat~~.

25. (Amended) The vehicle of claim 24, wherein the trained pattern recognition algorithm is a neural network or neural fuzzy algorithm.

31. (Amended) A ~~vehicle including a~~ system for determining the occupancy state of a seat in a vehicle in combination with the vehicle, the system comprising:

a plurality of transducers arranged in the vehicle, each of said transducers ~~providing~~ generating only a single stream of data relating to the occupancy state of the seat, and

processor means coupled to said transducers for receiving only ~~a separate~~ the single stream of data from each of said transducers such that the stream of data from each of said transducers is passed to said processor means from said transducer without combining with another stream of data and processing the streams of data to obtain an output indicative of the current occupancy state of the seat, said processor means comprising an algorithm created from a plurality of data sets, each of said data sets representing a different occupancy state of the seat and being formed from separate streams of data, each only from one of said transducers, while the seat is in that occupancy state,

said algorithm producing the output indicative of the current occupancy state of the seat upon inputting a data set representing the current occupancy state of the seat and being formed from separate streams of data, each only from one of said transducers.

32. (Amended) The vehicle of claim 31, wherein said algorithm is a neural network or neural fuzzy algorithm ~~processor means are arranged to process each of said separate streams of data independent of the processing of the other streams of data~~.

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34. (Amended) The vehicle of claim 31, wherein one of said transducers is a reclining angle detecting sensor for detecting a tilt angle of ~~the seat between~~ a back portion of the seat ~~and a seat portion of the seat~~.

49. (Amended) A ~~vehicle including a~~ system for determining the occupancy state of a seat in a vehicle in combination with the vehicle, the system comprising:

a plurality of transducers including at least two wave-receiving transducers arranged in the vehicle, each of said transducers providing data relating to the occupancy state of the seat, a first one of said wave-receiving transducers being arranged ~~on or adjacent to a ceiling of the vehicle~~ over a front portion of the seat or in front of the seat and a second one of said wave-receiving transducers being arranged ~~at a different location in the vehicle such that an axis connecting said first and second wave-receiving transducers is substantially parallel to a longitudinal axis of the vehicle, substantially parallel to a transverse axis of the vehicle or passes through a volume above the seat~~ over a rear portion of the seat or behind the seat, and

a processor coupled to said transducers for receiving data from said transducers and processing the data to obtain an output indicative of the current occupancy state of the seat, said processor comprising an algorithm which produces the output indicative of the current occupancy state of the seat upon inputting a data set representing the current occupancy state of the seat and being formed from data from said transducers.

51. (Amended) The vehicle of claim 49, wherein said first and second wave-receiving transducers are arranged to receive ultrasonic waves.

52. (Amended) The vehicle of claim 49, wherein each of said transducers generates only a single stream of data relating to the occupancy state of the seat and said processor means are arranged to accept only ~~a separate~~ the single stream of data from each of said transducers such that the stream of data

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from each of said transducers is passed to said processor means without combining with another stream of data~~, said processor means being further arranged to process each of said separate streams of data independent of the processing of the other streams of data~~.

53. (Amended) The vehicle of claim 49, wherein said ~~second~~ first wave-receiving transducer is arranged on an instrument panel of the vehicle.

61. (Amended) The vehicle of claim 49, wherein said plurality of transducers includes a reclining angle detecting sensor for detecting a tilt angle of ~~the seat between~~ a back portion of the seat ~~and a seat portion of the seat~~.